a few chapters. These, however, are of less interest as not embodying the results of his personal observations, but being a discussion of the various well-known moral, mental, and physical characteristics of mountaineers. To these follow chapters on the influence of mountain travelling on health, and detailed experiences of the application of artificial rarefaction of the air in disease.

With the desire of making the work as complete on the subject as possible, the author has compiled a large part of it from well-known writers, and recapitulates much that is of everyday observation; and these parts have naturally less interest than those which deal directly with his Mexican experiences. The whole of the facts, however, which bear upon the question discussed are conveniently collected together and put in an interesting form for the perusal of the general reader, for whom, however, much of it has too medical an aspect.

OUR BOOK SHELF

The Royal Tiger of Bengal: his Life and Death. By J. Fayrer, M.D. (London: J. and A. Churchill.)

In this small work Dr. Fayrer gives a popular description of the zoological relationships, anatomical structure, geographical distribution and habits of the tiger. Accounts are also introduced of tiger-hunts, which well exemplify the dangers to be feared and the precautions to be taken in the pursuit of that large game, which even under the most favourable circumstances cannot be followed without a great amount of risk. The author's considerable Indian experience gives great weight to his opinions on many of these points, especially with reference to the nature of the wounds inflicted by the enraged creature.

Anatomically Dr. Fayrer brings to our notice a point in the disposition of the claw-bearing or ungual phalanges of the digits in the cat-tribe, which is not without interest. In the fore-limbs, as is well known, these bones, when the claws are fully retracted, bend extremely backwards in order to allow of the claws themselves being protected during progression. To so great an extent is this retraction carried, according to Prof. Owen, that the bone passes back to the side of the second phalanx in the same way that the blade of a clasp-knife may be said to do the same with reference to each lateral portion of the handle. In the hind limb of the tiger, Prof. Owen remarks that they are retracted in a different direction, "viz., directly upon, not by the sides of the second phalanges, and the elastic ligaments are differently disposed." Dr. Fayrer finds that in the smaller Felidæ, as the Ocelot, the hind claws are constructed and retracted on exactly the same principle as the fore. Such being the case, either the tiger differs from its smaller congeners, or Prof. Owen is wrong. Till Dr. Fayrer proves the latter, we prefer to assume that the former is the case.

"Contrary to custom, I propose to give him (the tiger) precedence of the lion. He is generally described as inferior, though nearly equal, to the so-called king of beasts; but in size, strength, activity, and beauty he really surpasses him; and therefore, though he may neither be so courageous nor so dignified, he is entitled to the first place—at all events in India." Thus says our author, and many of his descriptions fully exemplify all the animal's best points. Nevertheless, though he may be slightly greater in length, and is perhaps more active, we considerably doubt his greater strength, and as the work before us fully proves, we cannot say of him as a recent writer tells us of the lion, that "it should always be recollected, before meddling with lions, that if you do come to close quarters with them death is the probable result," the tiger having a much less dignified habit, an example or two of which we quote with reference to a case in the Madras Presidency, where a sportsman wounded the creature more than once. "It charged and seized him by the loins on one side, gave him a fierce shake or two, dropped him, and then seized him on the other side, repeated the shaking and again dropping, left him and disappeared." In a second instance a military man, "a most distinguished soldier and sportsman, when following a wounded tiger on foot in the long grass, was suddenly seized and carried off by the animal he was seeking. He managed, however, to effect his escape without having received any serious injury, and rejoined his companions, who had deemed him lost."

When so acute an observer as the late Mr. Edward Blyth, with his great experience, expresses uncertainty as to whether the lion or the tiger is the larger animal, we may be certain that there is no great difference either way. Dr. Fayrer tells us, "I have been informed by Indian sportsmen of reliability, that they have seen and killed tigers over twelve feet in length." In none of the special instances he mentions, in which careful measurements were made, did the length exceed ten feet by more than an inch. We quite coincide with the author in looking with doubt on Buffon's statement that one has attained the length of fifteen feet.

For further information on the above and kindred points with reference to the Royal Tiger of Bengal, we cannot do better than recommend the reader to glance through the small work under review.

An Introduction to Animal Physiology. By E. Tulley Newton, F.G.S. (Mumby's "Science and Art Department" series of Text Books.)

In more than one of the Science Primers which we have lately had occasion to look through and notice, it has been painfully apparent that the author is not nearly so well grounded in the subject he is endeavouring to teach as even some of his probable pupils. Some write on human physiology without having studied human anatomy; others even do not know their physiology. The author of the work before us is not one of these. It is accurate, and therefore reliable. The descriptions are precise and clear. The limits of space within which the author is confined have, in some of his descriptions, made it necessary for him to sacrifice clearness to a certain extent, but this cannot be avoided. A novel feature of the work is the addition to each chapter of a practical section, in which directions are fully given for study, by the student himself, of the more simple physiological and anatomical points referred to. These directions are particularly clear, and if carefully worked out by everyone who reads the book, will be found to lead to a sound knowledge of the first principles of physiological science. The illustrations, which are numerous, though mostly to be found elsewhere, are well selected, and sufficiently large to be distinct.

Abstracts and Results of Magnetical and Meteorological Observations at the Magnetic Observatory, Toronto, Canada, from 1841 to 1871. (Toronto, 1875).

In this thick pamphlet of 249 pages, Professor Kingston gives the results of an elaborate, able, and discriminative discussion of the magnetical and meteorological observations made at Toronto during the thirty-one years ending with 1871, in a series of fifty-one tables. To these are appended the daily observations from January 1863 to December 1871. While all the results of the observations, devised and carried out with so much care, and extending over so long a period, are of very great value, we would point to the wind observations as regards the diurnal changes, but particularly in their relations to differences of temperature, pressure, humidity, and cloud, and to light, moderate, and heavy falls of rain and snow respectively, as affording, from the fulness and

originality with which they are discussed, much valuable information on many intricate points which it would be difficult if not impossible to find elsewhere. The influence of Lake Ontario is seen in the diurnal changes of the wind, which in July is nearly S. from 10 A.M. to 3 P.M., W. at 5 P.M., nearly N. at midnight, about which it remains till 9 A.M, when it rapidly shifts to S.W., and ultimately to S. at 10 A.M. From October to March, when storms are most frequent, the greatest depression of the barometer and increase of vapour occur with winds from N.E. to S.S.E., and the greatest rise of the barometer and diminution of vapour with winds from W. to N.N.W. On the other hand, in summer the greatest depression of the barometer occurs with winds from E.N.E. to E.S.E., but the greatest increase of vapour with winds from E.S.E. to S.S.W. Most of the light falls of rain occur with winds from N.E. by S. to W., and of snow with winds from S.W. by N. to N.E.; most of the moderate falls of rain with winds from N.E. to S.S.W., and of snow with winds from N.N.W. to S.E.; and most of the heavy falls of rain with winds from N.E. to S.S.E., and of snow from N. to E.S.E. The importa nt bearing of these facts on the question of North American storms as well as on the climate of no inconsiderable portion of that continent is evident. Tables II. and XX. giving by interpolation-formulæ the mean temperatures and mean pressures of different days of the year, while of very slight scientific value, may be found to be useful in a meteorological office, but a simpler and in everyway more preferable table of normal daily values for pressure and temperature could be constructed from the arithmetic means of the thirty-one years' observations treated by Bloxam's method of averages.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

"Tone" and "Overtone"

In the very favourable estimate of the work I have done in my translation of Helmholtz, in your number for Sept. 23, I am aken rather severely to task for my use of "Sensations of *Tone*" on my title-page, and my refusal to use the expression *overtones* in the body of the work. The title was long a matter of anxious consideration to me, and I have not yet seen my way to improving it. True, practical musicians, physiologists, and artists have each their own, very different, technical meanings for *tone*. The two last generally use it without an article, and in the singular; but musicians are accustomed to speak of "*a* tone," or of *several* tones, when they allude to musical intervals. In common speech, however, all three agree with the outside world in speaking of a "loud and soft, gentle and angry *tone* of voice," of a "fine-*toned* instrument," of the "splendid or miserable *tone* produced by a violinist," of the "magnificent *tones* of the organ." That is, we are all accustomed to use *tone*, as I have done on my title, for "a musical quality of sound." I know no other single word in English which expresses the same conception. In the original German, Prof. Helmholtz (and after him Prof. Tyndall) endeavours to use *tone* for a "simple tone" only. Neither have contrived to be consistent in so doing. I have had to correct the text several times in my translation on this very point, and instead of using *tone* for "simple tone" only, which is a new conception, and *clang* (in English, a *din*) for "compound musical tone," which is also a new and not an easy conception, I have invariably used the word *tone* (except when distinguished by a capital letter—thus, *Tone*, for the interval) in the usual general sense of the word, and distinguished the particular cases by the prefix "simple" or "compound." It seems to me that this is not so much "a little waywardness" on my part, as a desire for scientific accuracy.

As to "overtones," it is well known to those who, like my reviewer, are acquainted with the work in the original, that Helmholtz's expression "Obertöne" is a mere contraction for "Obertheiltöne" or "Oberparzialtöne," both of which terms he not unfrequently uses, and these are literally rendered by my "upper partial tones." Waiving my strong linguistic objection to the term "overtones" as an English word, my scientific justification for not using it in my translation must be sought for in the fact that even the German "Obertöne" has led Prof. Helmholtz himself not unfrequently to its inaccurate use for "partial tones" simply, including the lowest partial tone, which the word was especially invented to exclude. Singularly enough, even my reviewer has many times fallen into the same error (NATURE, p. 451, col. 2) in speaking of the "overtones" of a pianoforte string. Thus he says, "the first six overtones are all audible," which is not correct; but he means "the *lowest* partial tone and first *five* of the *upper* partial tones," or briefly "the first six partial tones," which *is* correct. Again, he says, "the seventh and ninth (overtone) which are *inharmonious*, &c., which is not correct, for the *seventh* and *ninth* overtones are the *eighth* and *tenth* partial tones, and are perfectly harmonious; but he meant the seventh and ninth partial tones. Again, he cites from p. 126 of my translation, the relative force of the first six "partial tones," as they are there called, but refers the table to the first six "*over*tones," which is altogether incorrect. Now if such men as Helmholtz, who invented the term, and as my reviewer, who uses it familiarly, can be led by it into what with them are mere inaccuracies of *expression*, must we not look to the utmost confusion of *thought* among persons to whom the whole subject is new, and who employ the term with a very vague or loose conception of its meaning? In point of fact, many such cases have come to my notice. Hence, again, I cannot agree to think that my deliberate rejection of the word "overtones" is "the chief fault" or "a blot on the translation," but rather submit that it is a consistent endeavour to attain scientific accuracy of expression, and avoid confusion of thought.

I thank the reviewer for his generally favourable estimate, gladly accepting his rectification of the accidental Germanism "the musically beautiful" for "the beautiful in music," and I apologise for the length of this communication on the ground that it is not a merely personal vindication,

Sept. 25 ALEXANDER J. ELLIS

Colours of Heated Metals

I HAVE just watched the casting in gun-metal, in an engineering establishment in this town, of what is intended to be the rudder-post of a large vessel, which when completed will weigh about three tons. As the casting was a simple one, it was accomplished very quickly, and as the contents of the huge four-ton ladle were emptied into the mould, the dazzling stream of the metal flowed in a large volume over its lip. Brilliantly glossy it appeared as it broke through the folds of thin dross with which its surface was encrusted; and this it did at the lip of the vessel, while fold after fold of the encrusting pellicle was swept down the stream, and left behind it a straight or ragged edge of the thin film, from underneath which the metal welled out for a moment with an appearance on the surface of perfectly transparent purity. The appearance was a deception arising from the strong bluish-green colour of the light emitted by the pure surface of the metal, which I have never seen exhibited under similar circumstances by melted iron or steel. It extended also for only a short distance from the encrusting edge, the green colour soon passing into white, or paler green, where exposure to the air enveloped the metal again in a rapidly increasing film of oxides that tarnish its surface and render the stream white, or nearly so, in every part, excepting in a bluish-green ring, or border where the fresh metal made its appearance, and flowed over in a beautifully coloured stream from the mouth of the ladle. The strongest patches of the colour there were transient, the film of oxide apparently soon thickening enough to eclipse it, and by connecting itself to the broken edge of the thin film in the pot to tear away another fold, when the characteristic greenish glow of the metal immediately presented itself along the freshly-broken edge. I had watched and thus interpreted this beautifully varied play of natural colours in the molten stream for some time before it occurred to me that the peculiar hue of the freshly-exposed surface of the metal, glowing as it does with the brightness of what in the black film of oxide appears as white heat, is no other than the very colour of the heated metal which the theory of exchanges would lead us to expect. For as the colour of gun-metal in a cold state is yellow, the selective absorption of its surface in that condition must be exercised chiefly upon rays occupying the blue portion of the spectrum, and consequently in the heated state these rays